

## Monolithic Regulated Self-Biased HEMT MMIC's

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*K.W. Kobayashi, R. Esfandiari, B.L. Nelson, K. Minot, W.L. Jones, M. Biendenbender, R. Lai, K.L. Tan and J. Berenz. "Monolithic Regulated Self-Biased HEMT MMIC's." 1994 Transactions on Microwave Theory and Techniques 42.12 (Dec. 1994, Part II [T-MTT] (1994 Symposium Issue)): 2610-2616.*

This work benchmarks the first demonstration of a monolithic HEMT IC design which incorporates active regulated self-bias. The HEMT current regulator design consists of integrating an op-amp in a feedback configuration with the LNA to achieve gain, noise figure, and dc bias performance which is tolerant to threshold variations due to the HEMT process. The HEMT LNA bias current can be maintained to within  $\pm 3\%$  variation over a process threshold variation (V/sub gs/) of  $\pm 0.5$  V. The bias circuitry regulates the bias current to within 1.5% over a 100° C temperature range. The amplifier has a nominal gain of 10 dB and a noise figure of 2.5 dB over a 1-10 GHz bandwidth. Across several wafers with a threshold voltage spread of 0.5 V, the regulated LNA maintains repeatable gain and noise figure which varies by less than 1 and 0.75 dB, respectively. The monolithic regulated self-bias technique can be integrated with other HEMT MMIC's in order to improve the performance and reliability, as well as to reduce the cost and weight of Integrated Microwave Assemblies (IMA's).

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